

**ABSTRACT OF THE DISCLOSURE**

[0044] A diffraction grating coupled infrared photodetector for providing high performance  
5 detection of infrared radiation is described. The photodetector includes a three-dimensional  
diffractive resonant optical cavity formed by a diffraction grating that resonates over a range  
of infrared radiation wavelengths. By placing a limited number of p/n junctions throughout  
the photodetector, the photodetector thermal noise is reduced due to the reduction in junction  
area. By retaining signal response and reducing the noise, the sensitivity increases at a given  
10 operating temperature when compared to traditional photovoltaic and photoconductive  
infrared photodetectors up to the background limit. The photodetector device design can be  
used with a number of semiconductor material systems, can form one- and two-dimensional  
focal plane arrays, and can readily be tuned for operation in the long wavelength infrared and  
the very long wavelength infrared where sensitivity and noise improvements are most  
15 significant.